Journal of Institute of Science and Technology, 30(2), 65-74 (2025)
ISSN: 2467-9062 (print), e-ISSN: 2467-9240
https://doi.org/10.3126/jist.v30i2.84985

Research Article

ISOLATION AND IDENTIFICATION OF PATHOGENIC BACTERIA FROM STREET FOOD AT BHIMDATT MUNICIPALITY, KANCHANPUR, NEPAL

Jay Narayan Acharya[1], Ayushma Upadhyay[1],Sarita Bhatt[1], Dipak Raj Jaishi[2], Pusparaj Bhatt[1]
[1]Siddhanath Science Campus Mahendranagar, Kanchanpur, Nepal
[2]Central Department of Chemistry, Kirtipur, Kathmandu, Nepal
Correspondence: jaynarayan.815510@cdmi.tu.edu.np

(Received:** January 10, 2025; **Revised:** November 05, 2025; **Accepted:** November 15, 2025**)

ABSTRACT

Street food consumption has increased substantially in developing countries, including Nepal, and is often associated with poor hygiene practices and foodborne illnesses. This study identified the microbial load, pathogenic bacteria, and antimicrobial resistance patterns among street foods in Bhimdatt Municipality, Kanchanpur, Nepal. A cross-sectional study was conducted from January to April 2024, during which 50 samples (panipuri, chowmein, momo, samosa, and chutney) were collected from 10 major vending locations using convenience sampling. Total plate count (TPC) was performed using the pour plate method, and bacterial identification was based on colony morphology and standard biochemical tests according to *Bergey's Manual of Determinative Bacteriology*. Antimicrobial susceptibility testing was performed using the Kirby–Bauer disk diffusion method following CLSI guidelines. Out of 50 samples, 22 (44%) were contaminated with bacteria. Four bacterial species were isolated: *Staphylococcus aureus* (36%), *Escherichia coli* (32%), *Salmonella enterica* serovar Typhi (18%), and *Klebsiella pneumoniae* (14%). The mean TPC ranged from 2.70×10^7 to 7.28×10^7 CFU/g, which exceeded recommended international microbiological safety limits. All isolates were resistant to amoxicillin, whereas amikacin and ciprofloxacin demonstrated the highest effectiveness. Multidrug resistance was detected in 75% of *S. aureus*, 86% of *E. coli*, 75% of *S. enterica serovar Typhi*, and 67% of *K. pneumoniae* isolates. There was no association between food type and pathogen occurrence ($p > 0.05$), supported by Fisher–Freeman–Halton exact test with Monte Carlo (p=0.556). The presence of high microbial loads and multidrug-resistant bacteria in street foods indicates serious public health and food safety concerns. These findings highlights the urgent need for routine microbiological surveillance, improved hygiene practices among street vendors, and strengthened regulatory and public health interventions.

Keywords: Antibiotic resistance, Bacteria, Food-borne pathogens, Street food

INTRODUCTION

Street foods, defined as ready-to-eat foods and beverages sold in public places, play an important socio-economic role by providing affordable meals and generating employment, thereby serving as a primary source of income for millions of low-skilled vendors (Ackah et al., 2011; Adhikari & Phil., 2017). Since consumers can choose a variety of foods items at relatively low prices, street foods are one of the least expensive and most accessible means of obtaining nutritionally balanced meals outside the home, particularly for low-income populations (Kook & Balkaran, 2014). The increasing demand for inexpensive meals consumed outside the home, especially individuals commuting to work or school, has been driven by changing lifestyles and working conditions (Buted & Ylagan, 2014). Due to their affordability, accessibility, and convenience, street food vendors are common in developing countries, including Nepal (Adhikari, 2017).

Despite these benefits, the informal nature of the street food sector often results in inadequate hygiene and food safety practices, posing significant public health risks (Bryan et al., 1988; Chumber et al., 2007). The incidence of foodborne illnesses associated with street foods has increased over the past decade, largely due to contamination by pathogenic microorganisms during food preparation, post-cooking handling, and through the use of contaminated equipment, utensils, and serving accessories (Schmidt et al., 2003; Tambekar et al., 2008). Street food-related illnesses, such as cholera, typhoid fever, food poisoning, and diarrhea, remain a constant public health threat and hinder socio-economic development. these illnesses disproportionately affect school-age children and populations in low-income regions, who bear approximately 40% of the burden (Havelaar et al.,

2015). Epidemiological data indicate that unsafe foods, such as street foods, are responsible for illness in approximately 7.69% of the world's population (600 million people) annually and account for 7.5% of all fatalities (Alemu et al., 2018; Buted & Ylagan, 2014). A wide range of pathogens has been implicated in foodborne illnesses. These include bacteria such as *Bacillus cereus, Campylobacter jejuni, Clostridium perfringens, Escherichia coli, Listeria monocytogenes, Salmonella spp., Shigella spp., Vibrio cholerae, Staphylococcus aureus*, and *Proteus spp. Salmonella spp.* are a common cause of foodborne illnesses worldwide, including in Nepal, and are a leading cause of hospitalization and fatalities (Breuil et al., 2000). Although *S. Typhi* is considered a foodborne pathogen, its transmission through food is relatively uncommon, as the bacterium primarily spreads via fecal–oral contamination of water in areas with poor sanitation, highlighting that waterborne routes are the predominant source of infection.

Foodborne illnesses can also be caused by certain fungi, viruses, and parasites. The public health burden of these diseases is further exacerbated by the emergence and spread of multidrug-resistant foodborne microorganisms (Khairuzzaman *et al.*, 2014). Previous studies have reported frequent contamination of street foods by pathogenic bacteria, such as *Salmonella spp., Shigella spp., Staphylococcus aureus*, and *Escherichia coli* (Sultana et al., 2024; Khalif et al., 2018). Unhygienic handling practices, including contamination from raw materials, food contact surfaces, improper storage or refrigeration, and unsanitary working environments, are major contributors to bacterial contamination in street food (Du Toit & Venter, 2010). For instance, Nur *et al*. (2021) reported that most street foods were contaminated with fungi, *Pseudomonas,* and *Staphylococcus spp.*, while some samples contained *E. coli* and *Klebsiella spp.*, with a high microbial load exhibiting resistance to commonly used antibiotics. In Ethiopia, the microbiological quality of various ready-to-eat street foods showed varying degrees of contamination, and most isolated pathogens were resistant to commonly prescribed antibiotics, indicating that street foods can act as a vector for antimicrobial-resistant pathogens (Amare *et al*., 2019).

Since antimicrobial resistance (AMR) is a growing global health concern that complicates treatment and increases disease burden, understanding the prevalence and resistance patterns of pathogenic bacteria in street foods is critical. In Bhimdatt Municipality, Nepal, although some microbiological safety evaluations of street foods have been conducted (e.g., Bohara, 2018), antibiotic resistance profiles of isolated bacteria remain unknown, and no research has been conducted on street foods in the last five years. Therefore, this study aimed to detect and identify bacterial pathogens in street foods sold in Bhimdatt Municipality and to determine their antibiotic resistance patterns. The findings are expected to address existing knowledge gaps in Nepal, particularly regarding AMR, and provide evidence-based insight to inform policymakers and public health authorities in improving food safety regulations, controlling the spread of antibiotic-resistant bacteria, and safeguarding the health of street food consumers.

MATERIALS AND METHODS

A cross-sectional study was conducted in Bhimdatt Municipality, Kanchanpur, Nepal, from January to April 2024. The study covered ten distinct locations within the municipality—Park, Mainline, Gol Market, Bus Park, Aithpur, Bhasi, Khairbhatti, Majhgau, Gobriya, and Gadachauki—selected based on the high density of street food vendors and customers. A convenience sampling approach was used to select vendors at each site based on accessibility and willingness to participate. Vendors selling packaged foods and mobile vendors were excluded to ensure the study focused on stationary vendors preparing ready-to-eat street foods for public consumption.

Sample Collection

A total of 50 street food samples, including panipuri, samosa, momo, chowmein, and chutney, were collected from the ten locations. Samples were collected aseptically in sterile polythene bags, labeled with the food type and collection site using permanent markers, and transported to the laboratory at Siddhanath Science Campus within one hour of collection. Each sample was collected as a single unit from one vendor; replicate samples were not collected because of resource constraints.

Microbiological Analysis

1 gram of each solid sample was weighed in weighing balance and homogenized with the help of mortar and pestle. Approximately 1ml of distilled water was added to facilitate the homogenization. Then, 1 ml of homogenate was aseptically transferred into tube containing 9ml of distilled water and mixed well and again transferred to another 9ml tube and labeled as 10^{-1}. From this dilution, 1 ml is transferred to another tube containing 9 ml of distilled water to obtain 10^{-2} dilution. The procedure was repeated to prepare serial dilution up to 10^{-6} (Adhikari et al, 2012). For the liquid sample, 1ml was aseptically transferred into tube containing 9 ml of distilled water and label as 10^{-1} for

the first tube. Serial dilutions were prepared up to 10^{-6} using the same procedures described as above. From 5th and 6th tube, 1 ml aliquots were plated on Nutrient Agar and incubated for 24 hours at 37°C. The colonies were subcultured on selective and differential media such as MacConkey Agar(MA) , Salmonella shigella (SS) Agar, Blood Agar (BA), and Eosine methylene blue (EMB Agar), mannitol salt agar(MSA) and incubated at 37°C for 24 hours. Mac-conkey agar was used to differentiate bacteria into lactose fermenter and non-lactose fermenter. Blood agar was used for the hemolysis. SS agar was used for *salmonella* spp. EMB and MSA were used for the presence of Coliform and *staphylococcus aureus*. The colonies grown on selective media was employed for Gram staining and the colonies were further sub-cultured on nutrient agar for biochemical test. Gram staining was performed to differentiate Gram positive and Gram negative bacteria. Colonies were examined for morphology and confirmed via IMViC test for gram negative bacteria and other biochemical tests such as Catalase and Oxidase for Gram-positive including Gram-negative bacteria, following *Bergey's Manual of Determinative Bacteriology*.

Total Count of Bacteria

Total count of bacteria was performed by pour plate method. The plate count agar (PCA) was used for the enumeration of the total viable bacteria. One ml of diluent was taken from 5th and 6th tube and pipetted into the sterile petri-plate and molten PCA was poured into the petri-plates containing sample. After that the petri-plated were incubated at 37°C for 24 hours.

After 24 hours of incubation, the bacterial load was counted and calculated by using a formula

$$\frac{\text{CFU}}{\text{ml}} = \frac{\text{No. of colonies}}{\text{Inoculum size}} \times \text{Dilution factor}$$

After incubation the colony growth of bacteria in PCA was counted thoroughly and plates exhibiting 30–300 colonies were counted. For the heavy bacterial load where it is very difficult to count is denoted by TMTC which means Too Many to Count. Similarly, for the fewer bacterial load less than 30 is denoted by TFTC which means Too Few to Count. (Ema *et al.*, 2022)

Antimicrobial Susceptibility Testing

Antimicrobial Susceptibility Testing (AST) was performed using the Kirby-Bauer disk diffusion method on Mueller-Hinton Agar against the following antibiotics: Amoxicillin (10 µg), Ciprofloxacin (5 µg), Tetracycline (30 µg), Azithromycin (15 µg), Amikacin (30 µg), Nalidixic acid (30 µg), and Erythromycin (15 µg). To perform the test, inoculum was prepared by transferring loopful of pure subcultured colonies from Nutrient agar plate to sterile normal saline. The culture was then swabbed from normal saline onto the MHA plate using a sterile cotton swab. After that the antibiotics disc were placed on MHA plates and incubated for 24 hrs at 37°C. On next day, Diameter of Zones of inhibition (ZOI) were measured and interpreted according to CLSI 2020 guidelines. However, numeric ZOI values were not recorded during laboratory testing. Therefore, results are reported using CLSI-defined zone-diameter to know the resistance profile of isolated bacteria rather than showing exact ZOI value separately. Resistance to three or more classes of antibiotics was classified as multidrug resistance (MDR) (Magiorakos *et al*., 2012). The *E. coli* ATCC 25922 was used as a quality control strain.

Statistical Analysis

Data were tabulated and analyzed using Microsoft excel 2010 and SPSS version 27. Assumptions of the test, including expected cell frequencies, were checked prior to analysis. Since more than 20% of cells had expected counts less than 5 for several bacteria, Fisher's exact test or Fisher–Freeman–Halton exact test with Monte Carlo simulation (10,000 samples) was used.

RESULTS AND DISCUSSION

Out of 50 samples collected from 10 different locations, only 22(44%) samples were found to be contaminated with food-borne bacteria (Figure 1).

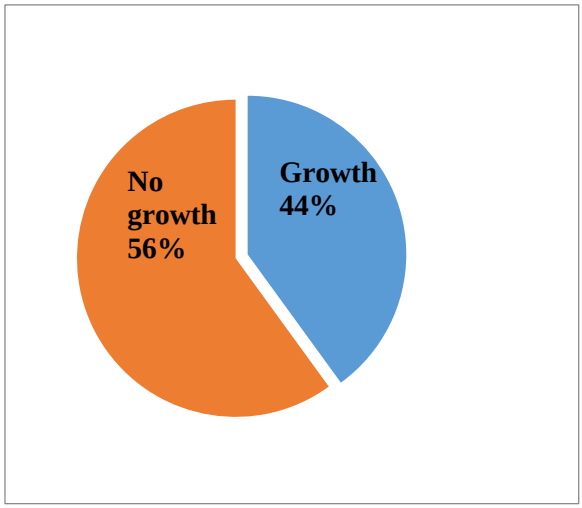

Figure 1: Bacterial growth among the collect samples.

Out of 22 positive samples, 8 samples were found to be gram-positive, and the remaining 14 samples were found to be gram-negative. In 8 samples, only 1 gram-positive cocci i.e. *Staphylococcus aureus*, was found,

whereas the remaining 15 samples were found to be contaminated with gram-negative bacteria. A total bacterial count of 50 street food samples was analyzed using plate count agar (Table 1).

Table 1. Total number of bacterial load in street food collected from 10 different sites. The sample sites were assigned as 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 representing Park, Mainline, Golmarket, Buspark, Aithpur, Bhasi, khairbhatti, majhgau ,Gobriya and Gaddachauki site.

Table 1: Total bacterial count for each street food.

	samples									
Sample Site	**Panipuri(CFU/g)**		**Chutney(CFU/g)**		**Samosa(CFU/g)**		**Momo(CFU/g)**		**Chowmein(CFU/g)**	
	10^5	10^6	10^5	10^6	10^5	10^6	10^5	10^6	10^5	10^6
1	TFTC	120	101	49	92	46	87	58	87	45
2	TMTC	105	88	43	78	41	64	32	34	TFTC
3	TMTC	99	79	38	62	31	11	83	36	TFTC
4	TMTC	123	TMTC	TMTC	150	95	160	81	90	46
5	97	68	90	44	50	32	TFTC	TFTC	30	TFTC
6	87	43	66	32	79	37	79	33	51	30
7	71	35	78	46	33	TFTC	63	38	TFTC	TFTC
8	40	TFTC	30	TFTC	TFTC	TFTC	TFTC	TFTC	TFTC	TFTC
9	83	42	55	30	70	42	33	TFTC	51	31
10	97	56	33	TFTC	31	TFTC	100	52	TFTC	TFTC

The total plate count (TPC) values exhibited considerable variation across different food samples and sampling locations. The lowest TPC was recorded in chowmein, with an average bacterial load of 2.70 × "10^7 " CFU/g, whereas the highest was observed in panipuri, with 7.28 × " 10^7 " CFU/g (Table 2). A study conducted by Paloma and Isral (2025) in Aklan, Philippines and Baidya *et al.* (2022) reported microbial counts of up to 3 × 10^3 CFU/g and and 7.04 × 10^3 CFU/ml, respectively, which is significantly lower than the values obtained in this study, indicating comparatively better hygiene practices in that region. In contrast, Tuladhar and Singh (2015) observed TPC values ranging from 8.83 × 10^5 to 2.60 × " 10^7 " CFU/g, which are higher than those reported by Paloma and Isral (2025) and Baidya et al. (2022), but still slightly lower than the bacterial counts observed in this study. This indicates that microbial contamination in this study was comparatively more severe. The variation in TPC values across studies may be attributed to environmental factors, differences in vendor hygiene, seasonal effects, sampling time, or disparities in local food handling practices, reflecting that these food may be unsafe for consumption.

Table 2. Distribution of average bacterial load in various street foods.

Types of street food samples	Total number of sample	Average bacterial load(CFU/g)
Panipuri	10	7.28×10^7
Momo	10	5.39×10^7
Samosa	10	4.29×10^7
Chaumein	10	2.70×10^7
Chutney	10	3.78×10^7

The highest bacterial load was recorded in the Buspark area (9.55 × 10^7 CFU/g), likely due to overcrowding, inadequate sanitation, and poor hygiene measures. In contrast, the lowest bacterial load was observed in Majhgau (3.50 × 10^6 CFU/g), possibly reflecting better hygiene and environmental conditions.

Table 3. Area wise distribution of average bacterial load.

Area	Total number of sample	Average bacterial load(CFU/g)
1. Park area	10	6.40×10^7
2. Main line	10	4.81×10^7
3. Golmarket	10	5.37×10^7
4. Buspark	10	9.55×10^7
5. Aithpur	10	4.25×10^7
6. Bhasi	10	4.16×10^7
7. Khaibhatti	10	3.56×10^7
8. Maghgau	10	3.50×10^6
9. Gobriya	10	4.06×10^7
Gaddachauki	10	3.34×10^7

Importantly, all TPC values in this study exceeded the acceptable safety threshold of 10^4 CFU/g(Table 2 and Table 3) as specified by the international safety limit of RTE food standard indicating that the sampled street foods were microbiologically unsafe for consumption. In addition to this, All the total mean aerobic bacterial load having $\geq 10^5$ CFU/g were considered as unsatisfactory by Alelign et al.,(2023) which meant to say that all our samples are unsatisfactory for consumption as the count was found to above 10^5 CFU/g.

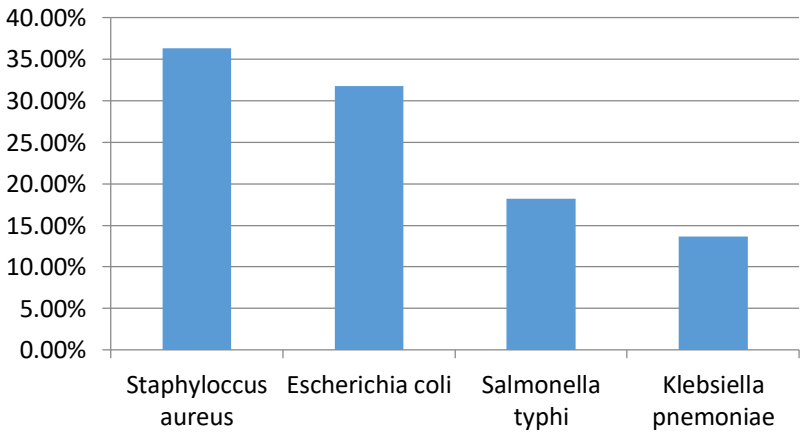

Figure 2: Bacterial occurrence in street food.

A total of 22 positive samples yielded four distinct bacterial isolates: *Staphylococcus aureus*, *Escherichia coli*, *Salmonella enterica serovar Typhi*, and *Klebsiella pneumoniae*. Among these, *S. aureus* (36%) was the most frequently isolated organism, followed by *E. coli* (32%), *S. Typhi* (18%), and *K. pneumoniae* (14%) (Figure 2). The predominance of *S. aureus* in the present study is in agreement with the findings of Amare *et al.* (2019) and Tuladhar and Singh (2015), who also reported *S. aureus* as the most commonly isolated pathogen from street foods. This high prevalence may be attributed to frequent human contact during food preparation and poor personal hygiene practices among street vendors. Additionally, *S. aureus* is part of the normal skin microbiota and can be easily transferred through unhygienic handling. The distribution of bacterial isolates in this study differed from Akilan *et al.* (2020), who reported E. coli as the most prevalent pathogen, whereas *S. aureus* predominated in our findings. The prevalence of *Salmonella* spp. (18%) in our study was comparable to it, indicating a similar level of enteric bacterial contamination in both study settings. Similarly, *Klebsiella pneumoniae* was detected at a relatively low prevalence (13.63%) compared to the 25% reported by Khalif *et al.* (2018). The observed variation may be attributed to several factors, including environmental conditions, vendor hygiene practices, the microbiological quality of water used in food preparation, the types and characteristics of street foods sampled, geographical and climatic differences, and the timing of sample collection. However, the absence of serotying for the confirmation of Salmonella enterica serovar Typhi in our study represents a limitation of this study. Moreover, *E. coli* (32%) was detected in our samples, which aligns with

previous reports on ready-to-eat street foods (Khadka *et al*., 2018; Giri *et al*., 2021; Yadav & Shrivastava, 2012; Bohara, 2018; Baidya *et al*., 2022), where *E. coli* is widely recognized as an important indicator of fecal contamination. Collectively, the presence of these enteric and opportunistic pathogens highlights the public health risk associated with the consumption of contaminated street foods and underscores the urgent need for improved hygiene, vendor training, and regulatory monitoring.

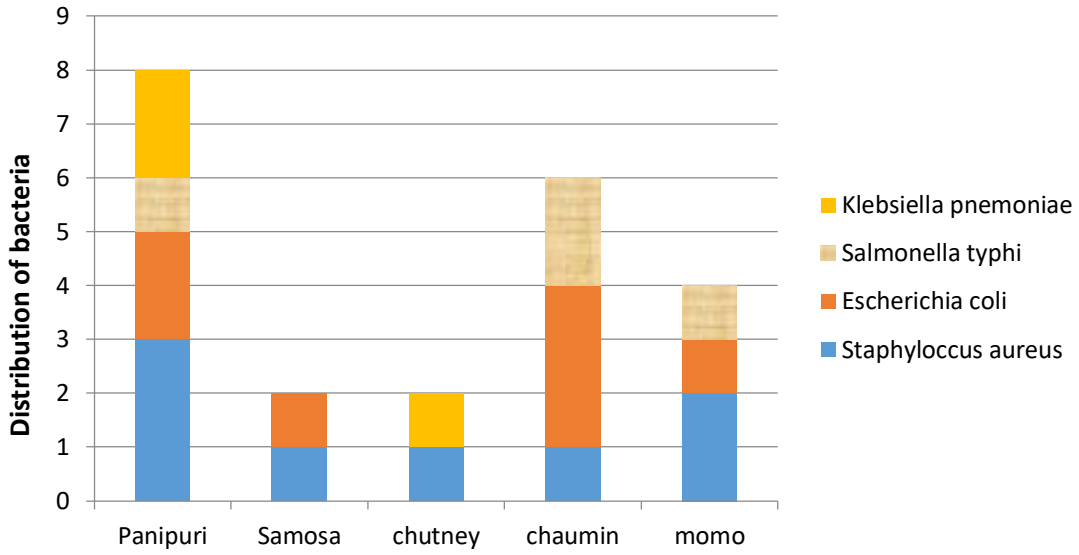

Figure 3: Food-wise distribution of bacteria.

On the other hand, out of 22 positive samples, 8 were Panipuri, 6 were Chowmein, 2 were samosas, 4 were momos, and 2 were chutney as shown in figure3. Among the 8 panipuri samples, 3 were contaminated with *staphylococcus aureus (37.5%)*, 2 with *Escherichia coli* (25%), 1 with *salmonella typhi* (12.5%) and 2 with *klebsiella pneumoniae* (25%). Among street foods analyzed, panipuri was found to be most heavily contaminated with all the bacterial isolates. This is due to the use of contaminated water, contaminated raw ingredients (rather than cooked), frequent use of bare hand contact, and being kept uncovered (Das *et al*., 2012).

Table 4. Test statistics evalutaing association between food type and isolated bacteria.

Test	Statistic value	df	Montero-carlo p (2 sided)	N
Pearson chi-square	4.319	4	0.556	50
Fischer-Freeman-Halton exact	3.956	0	0.556	50

There was no statistically significant association between food type and bacterial isolation (Pearson X^2 = 4.32, P= 0.556). Assumption checks showed that 50% of cells had expected counts less than five, therefore the Fisher –Freeman –Halton exact test was used which also indicated no significant association (P = 0.556) where where a p-value <0.05 is considered statistically significant (Table 4). This no significant association result were aligned with Lakhanpal *et al*. (2019) and Giri *et al*. (2021). The reason may be that contamination often originated from past cooking, handling, and storage rather than the food item itself.

Antibiotic sensitivity testing was carried out for *Staphylococcus aureus*, *Escherichia coli*, *Salmonella enterica serovar Typhi*, and *Klebsiella pneumonia* and the antibiotics pattern (Table 5).

Table 5: Antibiotic resistant patterns of the isolates.

Antibiotics used	Isolated bacteria			
	***Staphylococcus aureus* (8)**	***Escherichia coli* (7)**	***Salmonella enterica sarovar Typhi* (4)**	***Klebsiella pneumoniae* (3)**
1.Ciprofloxacin	6 –S 2-I 0-R	6 – S 1-I 0-R	2- S 2- I 0-R	2- S 0-I 1-R
2.Amoxycilin	0–S 0-I 8-R	0 – S 0-I 7-R	0- S 0- I 4-R	0- S 0-I 3-R
3.Tetracycline	1–S 2-I 5-R	0 – S 1-I 6-R	0- S 3- I 1-R	0- S 1-I 2-R
4. Azithromycin	5–S 3-I 0-R	3 – S 4-I 0-R	1- S 3- I 0-R	1- S 1-I 1-R
5. Amikacin	7–S 1-I 0-R	6 – S 1-I 0-R	2- S 2- I 0-R	3- S 0-I 0-R
6. Nalidixic acid	3–S 4-I 1-R	2 – S 3-I 2-R	1- S 2- I 1-R	0- S 1-I 2-R
7. Erythromycin	3–S 1-I 4-R	6 – S 0-I 1-R	1- S 0- I 3-R	0- S 2-I 1-R

Amikacin was the most effective antibiotic, with 100% sensitivity among *K. pneumoniae* and more than 85% sensitivity against *S. aureus* and *E. coli*. *Staphylococcus aureus* showed high sensitivity to amikacin (87.5%) and moderate sensitivity to azithromycin (62.5%). This also aligned with findings by Lakhanpal *et al.* (2019), who reported that *S. aureus* isolates from street foods were largely resistant to penicillins but retained sensitivity to aminoglycosides such as amikacin and gentamicin. Similarly, Tamang *et al.* (2020) in a Kathmandu-based study found 85% of *S. aureus* isolates from dairy and food products to be sensitive to aminoglycosides while showing high resistance to erythromycin and ampicillin. In contrast, amoxicillin was the least effective antibiotic, showing complete resistance (100%) in all four bacterial species tested. Ciprofloxacin showed good activity against *E. coli* (85.7%) and *S. aureus* (75.0%), while reduced activity was observed for *S. Typhi* (50.0%). Azithromycin was moderately effective, with 62.5% sensitivity in *S. aureus* and 42.9% in *E. coli*, but lower activity against *S.enterica serovar Typhi* (25.0%). *Escherichia coli* in this study demonstrated 85.71% sensitivity to ciprofloxacin and amikacin, indicating that fluoroquinolones and aminoglycosides remain effective treatment options. This is comparable to findings by Giri et al. (2021), who reported high *E. coli* susceptibility to ciprofloxacin (87%) in street-vended foods in Hyderabad, but noted declining sensitivity to ampicillin and co-trimoxazole. Tetracycline showed poor activity, with most isolates of *E. coli* (85.7%) and *S. aureus* (62.5%) resistant. Nalidixic acid exhibited variable results, with resistance in more than 50% of *E. coli* and *K. pneumoniae*. Erythromycin demonstrated reduced effectiveness, with resistance rates of 50% in *S. aureus* and 75% in *S. Typhi*. *Salmonella typhi* showed mixed susceptibility, with only 50% of isolates sensitive to azithromycin. This reduced sensitivity could be attributed to increasing empirical use of azithromycin for enteric infections in South Asia. According to Parvin et al. (2022), resistance to azithromycin among *S. typhi* strains in Bangladesh increased significantly in the past decade, suggesting possible cross-border trends. *Klebsiella pneumoniae* exhibited 66.67% sensitivity to ciprofloxacin but high resistance to erythromycin. Similar results were reported by Kumar et al. (2019),

who found that *K. pneumoniae* isolates from ready-to-eat meat products in Delhi were resistant to macrolides and beta-lactams but remained relatively sensitive to quinolones. Altogether, 6 (75.0%) *S. aureus*, 6 (85.7%) *E. coli*, 3 (75.0%) *S. Typhi*, and 2 (66.7%) *K. pneumoniae* isolates were found to be multidrug resistant (MDR). These findings reflect serious public health implications, particularly regarding the transmission of MDR organisms through contaminated food. However, Limited geographical coverage and small sample size shows the limitation of this study. Additionally, further interventions like molecular characterization of resistance genes, intervention-based studies on vendor training are required, covering a larger sample size to isolate and identify different pathogenic bacteria in the street food.

CONCLUSION

The result of the study hint about the maximum bacterial load in each street foods, showing unsatisfactory ($\geq 10^5$) for consumer and ultimately imparts health risk to them. The presence of *Staphylococcus aureus* and *E,coli* indicates an unhygienic practice of vendors, Poor hygienic environment and fecal contamination respectively. The presence of MDR pathogens in ready-to-eat foods represents a critical threat to public health. Effective monitoring, education on hygiene practices, and regular microbiological assessments are essential to ensure food safety and reduce the burden of foodborne illnesses in urban settings.

AUTHOR CONTRIBUTIONS

Conceptualization: Pushparaj Bhatt Investigation: Methodology: Jay Narayan Acharya and Pushparaj Bhatt Data curation: Sarita Bhatt and Ayushma Upadhyay Data analysis: Jay Narayan Acharya, Sarita Bhatt and Ayushma Upadhyay Writing - original draft: Jay Narayan Acharya Writing - review and editing: Jay Narayan Acharya and Deepak Raj Jaishi

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the microbiology lab of Siddhanath Science Campus, Tribhuvan University, Nepal, for providing laboratory facilities and technical support to carry out this work.

REFERENCES

Ackah, M., Gyamfi, E. T., Anim, A. K., Osei, J., Hansen, J. K., & Agyemang, O. (2011). Socio-economic profile, knowledge of hygiene and food safety practices among street-food vendors in some parts of Accra, Ghana. *Internet Journal of Food Safety*, 13, 191–197 https://cir.nii.ac.jp/crid/1370004239826389640.

Adhikari, D. B., & Phil, M. (2017). Informal street food trade: A source of income generation in urban Nepal. *Economic Journal of Development Issues*, 23(1–2), 1–17. https://doi.org/10.3126/ejdi.v23i1-2.28395.

Akilan, A., Revathi, K., Sundaravalli, K., & Devi, R. (2020*)*. Isolation And Identification Of Pathogenic Bacteria From Street Foods In Chennai. 24(1). 609–613 (PDF) Isolation And Identification Of Pathogenic Bacteria From Street Foods In Chennai.

Alemu, G., Mama, M., & Siraj, M. (2018). Bacterial contamination of vegetables sold in Arba Minch Town, Southern Ethiopia. *BMC Research Notes*, *11*(1), 775. https://doi.org/10.1186/s13104-018-3889-1.

Alelign, D., Yihune, M., Bekele, M., Oumer, Y., Beyene, K., & Atnafu, K. (2023). Bacteriological Quality and Antimicrobial Resistant Patterns of Foodborne Pathogens Isolated from Commonly Vended Street Foods in Arba Minch Town, Southern Ethiopia. *Infection and Drug Resistance*, *16*, 2883–2899. https://doi.org/10.2147/IDR.S411162.

Amare, A., Worku, T., Ashagirie, B., Adugna, M., Getaneh, A., & Dagnew, M. (2019). Bacteriological profile, antimicrobial susceptibility patterns of the isolates among street vended foods and hygienic practice of vendors in Gondar town, Northwest Ethiopia: A cross sectional study. *BMC Microbiology*, *19*(1), 120. https://doi.org/10.1186/s12866-019-1509-4.

Baidya, S., Nagarkoti, M., Kunwor, S., & Paudyal, R. (2022). Microbiological Analysis of Street Foods Sold in Kathmandu, Nepal. *Tribhuvan University Journal of Microbiology*, 82–88. https://doi.org/10.3126/tujm.v9i1.50413.

Bohara, M. S. (2018). Microbiological safety of street vended foods in Mahendranagar, Farwestern Nepal. *International Journal of Food Safety, Nutrition, Public Health and Technology*, 10(1), 1–9. https://tinyurl.com/32ph8x2x.

Breuil, J., Brisabois, A., Casin, I., Armand-Lefèvre, L., Frémy, S., & Collatz, E. (2000). Antibiotic resistance in salmonellae isolated from humans and animals in France: Comparative data from 1994 and 1997. *Journal of Antimicrobial Chemotherapy*, *46*(6), 965–971. https://doi.org/10.1093/jac/46.6.965.

Bryan, F. L., Michanie, S. C., Alvarez, P., & Paniagua, A. (1988). Critical control points of street-vended

foods in the Dominican Republic. *Journal of Food Protection*, 51(5), 373–383. https://doi.org/10.4315/0362-028X-51.5.373.

Buted, D. R., & Ylagan, A. P. (2014). Street food preparation practices. *Asia Pacific Journal of Education, Arts and Sciences*, *1*(2), 53–60.

Chumber, S. K., Kaushik, K., & Savy, S. (2007). Bacteriological analysis of street foods in Pune. *Indian Journal of Public Health*, 51(2), 114–116. https://tinyurl.com/22jts32d.

Das, M., Rath, C. C., & Mohapatra, U. B. (2012). Bacteriology of a most popular street food (Panipuri) and inhibitory effect of essential oils on bacterial growth. *Journal of Food Science and Technology*, *49*(5), 564–571. https://doi.org/10.1007/s13197-010-0202-2.

Du Toit, L., & Venter, I. (2010). Food practices associated with increased risk of bacterial food-borne disease of female students in self-catering residences at the Cape Peninsula University of Technology. *Journal of Family Ecology and Consumer Sciences* /Tydskrif Vir Gesinsekologie En Verbruikerswetenskappe, 33(1). https://doi.org/10.4314/jfecs.v33i1.52864.

Ema, F. A., Shanta, R. N., Rahman, Md. Z., Islam, Md. A., & Khatun, Mst. M. (2022). Isolation, identification, and antibiogram studies of Escherichia coli from ready-to-eat foods in Mymensingh, Bangladesh. *Veterinary World*, *15*(6), 1497–1505. https://doi.org/10.14202/vetworld.2022.1497-1505.

Giri, B. S., Gautam, D., Awasthi, G., Gyawali, P., & Baral, R. (2021). Prevalence and antibiotic susceptibility pattern of ESBL-producing Enterobacteriaceae isolated from ready-to-eat street foods. *Antibiotics*, 10(7), 850. https://doi.org/10.3390/antibiotics10070850.

Havelaar, A. H., Kirk, M. D., Torgerson, P. R., Gibb, H. J., Hald, T., Lake, R. J., Praet, N., Bellinger, D. C., Silva, N. R. de, Gargouri, N., Speybroeck, N., Cawthorne, A., Mathers, C., Stein, C., Angulo, F. J., Devleesschauwer, B., & Group, on behalf of W. H. O. F. D. B. E. R. (2015). World Health Organization Global Estimates and Regional Comparisons of the Burden of Foodborne Disease in 2010. *PLOS Medicine*, *12*(12), e1001923. https://doi.org/10.1371/journal.pmed.1001923.

Khadka, S., Adhikari, S., Rai, T., Ghimire, U., & Parajuli, A. (n.d.). *Bacterial contamination and risk factors associated with street-vended Panipuri sold in Bharatpur, Nepal*. https://tinyurl.com/fzhtd2pu.

Khairuzzaman, M., Chowdhury, F. M., Zaman, S., Mamun, A. A., & Bari, M. L. (2014). Food Safety Challenges towards Safe, Healthy, and Nutritious Street Foods in Bangladesh. *International Journal of Food Science*. https://doi.org/10.1155/2014/483519.

Khalif, M. A., Hossain, M. K., Rumi, N. A., Rahman, M. S., & Hosen, M. A. (2018). Identification and antibiogram study of bacteria isolated from different street food. *Asian Journal of Medical and Biological Research*, *4*(3), 279-287. https://doi.org/10.3329/ajmbr.v4i3.38467.

Kok,R. and Balkaran, R., 2014. Street Food Vending and Hygiene Practices and Implications for Consumers. Journal of Economics and Behavioral Studies, 6(3): 188-193 https://tinyurl.com/yhnexb59.

Kumar, A., Prakash, A., & Singh, S. (2019). Antibiotic resistance profile of Klebsiella pneumoniae isolated from street food and its public health significance. *Journal of Infection and Public Health*, 12(6), 881–885. https://doi.org/10.1016/j.jiph.2019.04.007.

Lakhanpal, N., Bedi, J. S., Sharma, A., & Gill, J. P. S. (2019). Characterization and antibiotic resistance profiling of Staphylococcus aureus isolated from ready-to-eat food samples. *Journal of Food Science and Technology*, 56(3), 1425–1431. https://doi.org/10.1007/s13197-018-03556-x

Magiorakos, A. P., Srinivasan, A., Carey, R. B., Carmeli, Y., Falagas, M. E., Giske, C. G., ... & Monnet, D. L. (2012). Multidrug-resistant, extensively drug-resistant and pandrug-resistant bacteria: An international expert proposal for interim standard definitions for acquired resistance. *Clinical Microbiology and Infection*, *18*(3), 268–281. https://doi.org/10.1111/j.1469-0691.2011.03570.x.

Nur, I., Talukder, M., Das, T., Asaduzzaman, M., Feroz, F., & Munshi, S. K. (2021). Microbiological status of some street iftar items collected from chalk bazar in Dhaka city, Bangladesh. *Food Research*, 5(3), 163–170. https://doi.org/10.26656/fr.2017.5(3).617.

Paloma, L. I., & Israel, P. R. (2025). Examining street food microbial count and street food vendors' safety practices in Aklan, Philippines. *Food Science and Technology*, 13(2), 117–126. https://doi.org/10.13189/fst.2025.130201.

Parvin, M., Haque, A., Islam, M. S., & Rahman, M. (2022). Rising resistance to azithromycin among Salmonella isolates in South Asia: Implications for typhoid treatment. *Antimicrobial Agents and Chemotherapy*, *66*(3), e01662-21. https://doi.org/10.1128/aac.01662-21.

Schmidt, R. H., Goodrich, R. M., Archer, D. L., & Schneider, K. R. (2003). General Overview of the

Causative Agents of Foodborne Illness: FSHN033/FS099, 2/2003. *EDIS*, *2003*(6). https://doi.org/10.32473/edis-fs099-2003.

Sultana, R., Alam, S. T., Akter, S., Mia, P., Nabila, S. S., Tasnim, S., ... & Uddin, M. A. (2024). Microbiological analysis of bacterial isolates obtained from salad dressing samples from street food vendors in Bangladesh along with their antibiogram profiling. *Journal of Preventive, Diagnostic and Treatment Strategies in Medicine*, *3*(2), 92–99. https://doi.org/10.4103/jpdtsm.jpdtsm_27.

Tamang, A., Mahato, A., & Poudel, R. (2020). Detection of Staphylococcus aureus from dairy products and their antibiotic susceptibility patterns. *Nepal Journal of Science and Technology*, *19*(1), 73–80. https://doi.org/10.3126/njst.v19i1.28584.

Tambekar, D. H., Jaiswal, V. J., Dhanorkar, D. V., Gulhane, P. B., & Dudhane, M. N. (2008). Identification of microbiological hazards and safety of ready-to-eat food vended in streets of Amravati City, India. Journal of Applied Biosciences 7:195-201.

Tuladhar, R., & Singh, A. (2015). Bacterial Analysis and Survey of the Street Food of Kathmandu in Relation to Child Health. *Journal of Natural History Museum*, *26*, 1–9. https://doi.org/10.3126/jnhm.v26i0.14126.

Yadav, B. P., & Shrivastava, U. P. (2012). Microbial Contamination of Food Available in Sub Metropolitan City Birgunj in Nepal and Its Effect on Human Health. *International Journal of BioSciences and Technology*, 5 (15): 82– 875.